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Patients' Preferences Explain A Small But Significant Share Of Regional Variation In Medicare Spending

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Abstract

This study assesses the extent to which differences in patient preferences across geographic areas explain differences in traditional (fee-for-service) Medicare spending across Dartmouth Hospital Referral Regions. We find that that preferences explain 5% of variation across areas in total Medicare spending. By comparison, supply factors explain 23%; patient health and income explain 12%. The contribution of preferences is largest for end-of-life spending and smallest for physician services. We conclude that variation in patient preferences contributes to differences across areas in Medicare spending. Medicare policy must consider both supply factors and patient preferences in deciding how much to accommodate area variation in spending and the extent to which variation should be subsidized by taxpayers.

Introduction

For more than 20 years, the Dartmouth Atlas has documented two striking facts. First, Medicare spending and treatment decisions vary considerably across geographic areas, even after adjusting for differences in beneficiaries' age, health status, and cost of living.[1] Second, area differences in the use of health services are not consistently correlated with differences in quality or health outcomes.[2,3,4] This body of work forms an important basis for the view that there are significant inefficiencies in the Medicare program.[5]

Yet, despite the contributions of this research, it has left some questions unanswered. Although existing work highlights the pervasiveness and persistence of area variations in care, it has done less to identify their causes. In particular, relatively few studies have explored the role of patient preferences in determining area variations.[6,7,8,9] The recent Institute of Medicine report on area variations identifies the measurement of preferences as a new question that its analysis exposes but does not investigate.[10] Patients may vary in the amount and types of medical care they prefer, even when they have similar demographic and health characteristics; regional variations in tastes could easily lead to variations in the care that patients actually receive.

Better understanding of the role of patient preferences is valuable for two reasons. First, if preferences affect area variations and satisfaction of preferences (independent of medical need) is considered to be a valid social goal, then policymakers may wish to preserve at least some geographic differences in care. In this case, changes to Medicare that seek to eliminate area variations may not make patients better off in terms of their subjective experience with the health care system. Second, even if satisfaction of preferences is not considered valid in

and of itself, the presence of a relationship between preferences and area variations may be important to policymakers. In this case, changes to Medicare that seek to reduce variations will need to affect the choices not only of health care providers but also of patients in order to be as effective as possible.

We explore the contribution of preferences to area variations by matching data from several sources at the level of a hospital referral region (HRR) and estimating the effect of patient preferences on Medicare spending, controlling for other supply factors, including the number of physicians, specialists, and hospital beds per capita; and patient characteristics including median area income and health status. We calculate how much of the difference in spending between HRRs in the top quintile of spending and HRRs in the bottom quintile is accounted for by the difference in patient preferences between these two types of areas.

Data and Methods

We use data from three sources. First, we obtained HRR-level 2005 spending (total, inpatient, and end-of-life) and mortality for fee-for-service Medicare beneficiaries, and 2006 physicians, specialists, and hospital beds per capita from the Dartmouth Atlas website.[11] Second, we obtained 2006 median household income by county from the Area Resource File; we apportioned counties to HRRs on the basis of the population in each of the county's zip codes.[12] Third, we obtained survey data on patients' preferences for care and self-reported health status from the Dartmouth Institute for Health Policy and Clinical Practice. This survey was conducted between June and December of 2005 using a national random sample of approximately 4,000 elderly Medicare beneficiaries. From this survey data, we were able to calculate HRR-level measures of average preferences for care and health status for 290 HRRs. We adjusted all series for differences across HRRs in age, gender, and race; the spending data were also adjusted for differences in prices.[13]

Our construction of preference measures from the survey follows previous work.[7] We develop measures of preferences from six survey questions. The first three, "Visit doctor right away for a health problem", "Get tests even if doctor thought unnecessary", and "See specialist even if doctor thought unnecessary" are based on whether respondents presented with scenarios in which they had new chest pain and, separately, a cough persistent two days after other flu symptoms had passed, would decide to see a physician right away, want tests even if their doctor said they were not necessary, or want to see a specialist even if their doctor thought it unnecessary. The fourth, "Worry about health more than people my age" is based a question about whether respondents say they worry about their health more, less, or the same amount as people their age. The last two, "Take drugs to prolong life even if they made me feel worse" and "Decline drugs that shorten life even if they made me feel better" are based on questions about preferences for use of drugs with significant side effects at the end of life. Detailed information about the construction of the measures, and the questions themselves, can be found in the online appendix.

We use regression analysis to examine the relationships between preference measures and spending, in some models also including supply measures and patient characteristics. We estimate HRR-level ordinary least squares models in which the dependent variables are

measures of spending; the independent variables include the share of respondents answering the preference questions affirmatively and other variables. In some models we enter each preference measure separately, and in others we enter all simultaneously. Using the regression results, we calculate the share of the difference between the highest and lowest spending areas explained by the preference measures, supply, and patient characteristics.

Results

Table 1 presents means and standard deviations of supply factors, patient characteristics, and preferences for the 290 HRRs for which we have data (except for the end-of-life preference questions, which were only available for beneficiaries from 286 HRRs). Means and standard deviations for the supply factors and median income were weighted by 2006 HRR population levels; means and standard deviations for survey responses (i.e., self-reported health status and preferences) were weighted by the number of survey respondents. The number of hospital beds per 1,000 people is significantly positively related to the spending quintile of an HRR: in the lowest quintile of spending, there are 2.188 beds per 1,000, but in the highest quintile, there are 2.525. Consistent with previous work, the number of physicians per 100,000 population is significantly negatively related to the spending quintile of an HRR.[11] The mortality rate of Medicare beneficiaries, adjusted for age, gender, and race, is positively related to spending quintile. The direction of causality in this relationship is of course unclear; higher rates of spending might be leading to worse health, but also might reflect pre-existing differences in health.

In bivariate comparisons, area-level spending is correlated with patient preferences. For example, 57.6% of patients who live in the lowest-spending quintile of HRRs say that they would prefer to visit a doctor right away when they had a health problem, as compared to 62.3% of patients in the highest-spending quintile ($p = 0.008$). The same directional relationship holds for all of the measures of preferences that we analyze, although the trend across quintiles is only statistically significant at conventional levels in 4 of 6 of them.

Table 2 presents results from HRR-level regressions of adjusted total spending on preferences, with and without controls for the other factors listed in table 1. Each entry in the table represents a coefficient from a separate regression for each preference measure. The table shows that preferences have a modest but statistically significant association with area average total Medicare spending per beneficiary. In a simple bivariate model that excludes controls for supply, health, and income, changing the proportion of individuals in an HRR who express a preference for visiting a doctor right away in response to a health problem from 0 to 1 is associated with a $1,096 increase in HRR-average spending ($p < 0.01$). Scaled in terms of the distribution of preferences across HRRs, a one-standard-deviation increase in the preference for seeing a doctor right away would lead to a $171 (=0.156*$1,096) increase in HRR-average spending (standard error $60, $p < 0.01$), or about 2.2 percent of the average spending of $7,718. Controlling for supply factors, health, and income reduces the estimated effect of this measure of preferences to $920 for a change in the proportion of individuals in an HRR who express the preference from 0 to 1 ($p < 0.01$), but does not eliminate it. Scaled in terms of the distribution of preferences across HRRs, this

represents a $144 (=0.156*$920) increase in spending (standard error $50, $p < 0.01$), or about 1.9 percent of the average spending of $7,718.

Most of the other measures of preferences have a similar effect. For example, in a simple bivariate model, a one-standard-deviation increase in the preference for specialist visits would lead to a $166 (=0.154*$1,080) increase in HRR-average spending (standard error $62, $p < 0.01$); after controlling for supply factors and patient characteristics, this estimate falls to $128 (=0.154*$830). Two of the six measures of preferences -- the extent to which a respondent self-reports worrying more than average about health, and the preference for drugs to prolong life -- do not have a statistically significant effect on area spending, after controlling for supply factors and patient characteristics.

We next modeled the joint effects of the six measures of preferences on spending, controlling for supply factors and patient characteristics. Here, we estimated separate regression models of the effects of preference measures on total spending and on three components of spending: inpatient services, physician services, and spending in the last six months of life.[14] The regression results show that the most consistently powerful predictor of area variations is the preference for visiting a physician right away; this measure is statistically significant, and economically important, in three of the four spending models. The results also suggest that the measures of preferences are highly correlated; once all six measures are included, only one or two are individually statistically significant.

From the regression results, we derived estimates of how much each of the three sets of explanatory variables -- supply factors, patient characteristics, and preferences -- contribute to area differences in each component of spending. These are shown in Table 3. The first row of the table presents the difference in each component of spending between the top and bottom quintile of each distribution. For example, total Medicare spending in the top fifth of HRRs was $9,011 per beneficiary on average; spending in the bottom fifth was $6,177, or $2,834 less.[15] We calculated the difference between the top and bottom quintiles in average inpatient, physician, and end-of-life spending in the same way.

The remaining rows show how much of the difference in spending between the top and bottom quintiles is explained by differences in supply factors, patient characteristics, and preferences for each type of spending. For total spending, differences in the supply of physicians and hospital beds account for $655 of the difference in spending ($p < 0.01$), or 23.1 percent. By comparison, differences in health and income account for $352 ($p < 0.01$), or 12.4 percent; differences in preferences account for $129 ($p < 0.01$), or 4.6 percent. In total, the three sets of controls explained 40.1 percent of the difference (= 0.231+0.124+0.046), leaving 59.9 percent of the difference unexplained.

Another way to put the effect of preferences on area variations in perspective is to examine what would happen if preferences changed by one standard deviation. Based on the models underlying Table 3, we find that a one-standard-deviation increase in all six measures of preferences would lead to a $407 increase in spending (standard error $115). This is about three times larger than the amount of the across-quintile spending difference that preferences accounted for in Table 3. But, the questions being asked by the two analyses are different. In

Table 3, the result is based on the size of the preference differences between the spending quintiles. In this analysis, the result is based on the amount of variation in preferences throughout the population, which is larger.

The second, third, and fourth columns show this breakdown for the different components of spending. Overall, our controls explain roughly the same share of the difference between high- and low-spending areas, ranging from 36.2 percent for end-of-life to 45.3 percent for inpatient spending. However, the relative contribution of each set of controls differs for each measure of spending. Supply factors explain the largest share of area differences in physician spending, and the smallest share of differences in end-of-life spending. Health and income explain the largest share of area differences in inpatient spending, and the smallest share of differences in physician spending. Preferences explain the largest share of differences in end-of-life spending, and the smallest share of differences in physician spending. In particular, for physician spending, preferences explain roughly one-tenth as much as do supply factors, but for end-of-life spending, preferences explain roughly half as much.

To investigate whether these findings were sensitive to specification, we estimated the responsiveness of total spending to an aggregate measure of preferences for intensive treatment. Using this specification, preferences explained slightly more of the variation in spending across HRRs than in the specification underlying table 3, although the difference was not statistically significant at conventional levels.[16]

Discussion

What is the relative importance of supply factors, patient characteristics (health status and income), and preferences in explaining area differences in Medicare spending? Although significant effort has been devoted to documenting area variations, less attention has been given to understanding their causes. We find that patient preferences are a statistically significant and economically important piece of the area-variations puzzle.

Our results help explain why previous studies have reached divergent conclusions. We examine the effect of area-average preferences on area-average spending, holding constant other area characteristics like patient health and income. Previous work found no effect of area-average outpatient visit rates on individual preferences, holding constant other individual characteristics.[7] Our finding of a significant effect could therefore be due to three factors: our analysis of total spending rather than utilization of a specific service; our analysis of regional rather than individual variations in preferences; or our analysis of spending rather than preferences as the dependent variable.

Our results also indicate that preferences have a greater effect on end-of-life care than physician services, reflecting another difference between studies with positive and null results. This finding suggests that efforts to enable people to understand and act on their preferences could reduce area variation; use of advance directives have been shown both to lead to care that better reflects patient preferences[17] and to reduce end-of-life spending in high-spending areas.[6]

Nonetheless, we find that supply factors, health, and income explain far more area variation in spending than do preferences. Our results should therefore not be interpreted as conflicting with previous work documenting the importance of these factors. Rather, our findings are important from a policy perspective because they imply that efforts to reduce area variations will be most effective if they account for both the role of supply factors and patient preferences.

Our findings pose other challenges for policy makers. Analyses of area variation have concluded that resource use in high spending areas is socially wasteful if it does not contribute to improved health outcomes. This is consistent with a public economics model of commodity egalitarianism, in which the principal goal of Medicare is to ensure that all elderly individuals get health services sufficient to deal with illness.[18] In contrast, one might consider satisfaction of preferences to be a valid objective in and of itself. Conventional microeconomic theory, for example, considers both satisfaction of preferences and achievement of improved outcomes as valuable, to be balanced according to the intensity of individuals' desires for them and their relative costs. Deciding how much deference to give to preference-based variation requires difficult judgments. First, it requires deciding whether patient preferences should be accommodated by the Medicare program at all and, if they are to be accommodated, how strongly. Second, it requires deciding how responsibility for the costs of preference-based variations should be apportioned between individual patients and taxpayers. Third, in practice, it requires disentangling preference-based variation from other sources -- such as supply factors -- that policy makers may not wish to support.

Limitations in our analysis may lead it to either over- or understate the true effect of preferences on area variations. First, we do not account for the possibility that supply factors, health status, and preferences might be jointly determined at the area level. If supply factors cause differences in patient preferences, then we would overstate the true effect of preferences. For example, patients' desire for intensive treatment may be developed or refined by living in an area with many specialists. Alternatively, preferences may cause differences in supply, in which case we would understate the true effect of preferences. Of course, if patient preferences are actually capturing something else about geographic areas not included in our analysis, this would lead us to overstate the importance of preferences as well. To address this concern, we adjusted all covariates for age, gender, and racial differences across areas and accounted for differences in mortality rates, self-reported health, and income, but our adjustments are necessarily incomplete. For example, other work has found that models that use more detailed patient diagnosis data to control for health status attribute more area variation to health status and less to supply factors.[19] Although there is some debate over the appropriateness of this approach,[20] use of more detailed diagnosis data could have a similar effect on our estimates of the effect of preferences.

Second, we do not account for the possibility that our proxies measure true patient preferences with error. If the measurement error in our proxies for preferences were uncorrelated with supply factors, area health, and income, then our estimates of the effect of preferences would understate the true effect; this is just a special case of the classical errors-in-variables or attenuation bias problem.[21] However, if measurement error in our proxies

were correlated with other observed determinants of area spending, then our estimates of the effect of preferences could either over- or understate the true effect of preferences, depending on the magnitude and direction of these correlations.

Our analysis suggests several areas for future research. Along with other work, we find a greater effect of preferences on end-of-life care than on physician services; better understanding of the mechanism driving this difference is important. In addition, our models implicitly assumed that preferences had a homogeneous effect. Future work might explore whether market factors such as competition or managed care or laws and regulations act as moderating factors that either strengthen or weaken the link between preferences and area variations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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13. We describe the adjustment process in greater detail in the online appendix.

14. A complete set of regression results can be found in the online appendix.
15. A complete set of descriptive statistics on spending across HRRs can be found in the online appendix.
16. We defined the aggregate measure as the average of the six measures, after converting each to a z-score (dividing it by its standard deviation). Differences in the aggregate measure between the top and the bottom quintiles accounted for $171 of the difference in spending ($p < 0.01$), or 6 percent.
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Table 1

Means of Variables Used in Analysis (Standard Deviations in Parentheses)

		Mean by quintile of total spending					
	Overall Mean (std. dev.)	**Lowest quintile**	**2d quintile**	**3rd quintile**	**4th quintile**	**Highest quintile**	**p-value of trend**
Supply							
Hospital beds per 1,000 pop	2.394 (0.500)	2.188	2.256	2.358	2.515	2.525	<0.001
Physicians per 100,000 pop	201.7 (32.5)	214.4	200.1	198.5	206.5	193.1	0.010
Specialists per 100,000 pop	127.1 (22.0)	130.5	126.0	125.5	130.9	123.4	0.316
Health and Income							
Mortality rate of Medicare FFS beneficiaries	0.052 (0.005)	0.048	0.052	0.052	0.054	0.054	<0.001
Self-reported health status is fair or poor	0.297 (0.157)	0.279	0.308	0.341	0.281	0.285	0.565
Self-reported health status is very good or excellent	0.310 (0.153)	0.368	0.288	0.287	0.304	0.316	0.421
Median income	50372 (8596)	50803	50803	50083	50613	49772	0.512
Preferences							
Visit doctor right away for health problem	0.588 (0.156)	0.576	0.543	0.573	0.605	0.623	0.008
Get tests even if doctor thought unnecessary	0.830 (0.122)	0.833	0.806	0.804	0.841	0.851	0.082
See specialist even if doctor thought unnecessary	0.639 (0.154)	0.609	0.620	0.594	0.662	0.674	0.005
Worry about health more than people my age	0.135 (0.105)	0.112	0.125	0.143	0.125	0.159	0.033
Take drugs to prolong life even if they made me feel worse	0.175 (0.128)	0.156	0.189	0.166	0.177	0.179	0.620
Decline drugs that shorten life even if they made me feel better	0.318 (0.154)	0.279	0.291	0.340	0.333	0.329	0.046

Notes: N = 290 HRRs for which we have patient preference data, except for end-of-life questions where N = 286. All variables adjusted for age/gender/racial differences across HRRs.

Table 2

Estimated Effect of Preferences on Total Medicare Spending at the HRR Level

Visit doctor right away for health problem	1096 *** (385)	920 *** (322)
Get tests even if doctor thought unnecessary	654 (401)	979 *** (323)
See specialist even if doctor thought unnecessary	1080 *** (401)	830 ** (345)
Worry about health more than people my age	1296 ** (607)	850 (609)
Take drugs to prolong life even if they made me feel worse	571 (420)	314 (381)
Decline drugs that shorten life even if they made me feel better	921 *** (328)	666 ** (289)
Controls for supply, health, and income	No	Yes

Notes: *, **, *** represent statistical significance at the 10, 5, and 1 percent levels. Each table entry represents the effect of changing the proportion of individuals who express the listed preference from 0 to 1, holding constant the controls noted in the bottom row. N = 290 HRRs except for end-of-life models where N = 286. Regressions are weighted by the number of Medicare enrollees. Heteroscedasticity-consistent standard errors in parentheses.

Table 3

Contribution of Supply Factors, Health and Income, and Preferences to Differences in Medicare Spending Between the Top and Bottom Quintiles of HRRs

	Dependent Variable			
	total spending	**Inpatient (Part A)**	**physician services**	**end-of-life**
Difference in spending between top and bottom quintile	$2,834	$1,521	$1,210	$6,836
Contribution of supply factors	655 *** (105) [0.231]	253 *** (49) [0.166]	322 *** (51) [0.266]	929 *** (292) [0.136]
Contribution of health/income	352 *** (92) [0.124]	368 *** (58) [0.242]	90 *** (31) [0.074]	1027 *** (298) [0.150]
Contribution of preferences	129 *** (43) [0.046]	69 *** (18) [0.045]	34 *** (13) [0.028]	516 *** (154) [0.076]

Notes: *, **, *** represent statistical significance at the 10, 5, and 1 percent levels. Table entries are based on regressions of different measures of spending on all six measures of preferences, controlling for supply factors and health/income. Full regression results are reported in Appendix Table 3. Numbers in brackets represent the share of the effect of the described variables in the total difference in spending reported in the first row.